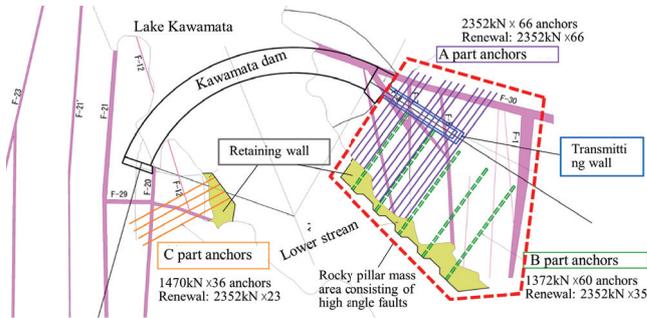


2. Renewal of large-scale PS rock anchors in Kawamata Dam foundation

Renewal of large-scale PS rock anchors in Kawamata Dam foundation

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Thus, we obtained data quantitatively such as machine rotation torque, striking pressure, water pressure and drilling speed in real-time. As for tensioning, the measurement of the load-displacement in real time was performed using the tension control system to achieve the high-accuracy tension control.



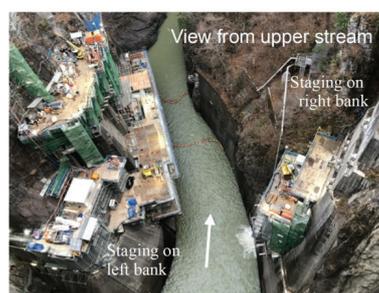
The centralized data management was performed using CIM (Construction Information Modeling) by ground exploration technology, borehole wall observation and so on. It achieved high-accuracy drilling by reflecting the drilling data. Eventually, it enabled more accurate drilling to avoid interference with other underground structures.



Outline

Kawamata Dam is a concrete arch dam with 117 m high which was completed in 1966 year. At the same time, a huge underground transmitting wall for sustaining the arch thrust force was constructed in the left foundation. To tighten this wall along, the large-scale PS anchors were installed, also to stabilize the steep slope and prevent the surface loosening.

However, recently, deterioration of PS anchors was confirmed by irregular behaviors observed in measured values, and damages in anchor heads were found. After these anomalies were checked by the technical committee, the full renewal of PS anchors and the repairment of the retaining wall were determined under the strict on-site condition of topography and climate. In the first renewal works from 2018 to 2021, 59 unit PS anchors of the total 124 units were installed (A part: 22/66 units, B part: 22/35 units, C part: 15/23 units), using the latest technology.



Integrity survey and anti-corrosion on PS anchors

By various integrity surveys, it was confirmed the deterioration of the fully bonded type anchor was very limited, compared to unbonded type. However, pitting corrosions leading to delayed fracture on steel bars were found, and very small step-like displacements were measured.

Considering these facts, the double anti-corrosion protection was decided combining fully bonded type and ECF (Epoxy Coated and Filled) strands. Further, a new non-shrink grout was developed to keep the high quality for 100 years.



High-pressure resistant cloth packers

Cloth packers weaved by a special fabric was developed for the enough injection under high pressure. This new packer was confirmed through on-site pull-out tests it could increase the frictional resistance greatly around cloth packer by removing only water from grout.



Drilling management

To obtain dynamic information during drilling immediately, ground exploration sounding device was attached to the drilling machine.